BIOCHEMICAL AND THERAPEUTIC STUDIES ON POSTPARTUM INDIGESTION (PPI) IN BUFFALOES

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INTRODUCTION

- Buffalo Population (FAO, 2008):
  - World 185.29 millions
  - India 105.10 millions (57%)
  - Telangana 4.19 millions (2012) (4%)
- Milk Production (GOI 2011-12):
  - India: Total Milk 127.90 Mill Tons
  - Buffaloes 65.35 Mill Tons (51%)
INTRODUCTION

• Objectives:
  1. To study the incidence of PPI in buffaloes associated with hepatic insufficiency and production diseases.
  2. To conduct a detailed clinical examination of cases of PPI (i.e., 0-2 months after calving).
  3. To study the involvement of liver in PPI with the help of biochemical indices.
  4. To study the association of PPI with subclinical forms of hypocalcaemia and ketosis.
  5. To evolve suitable therapeutic and prophylactic measures for their prevention.
MATERIALS AND METHODS
• Selection of animals
• Clinical Examination
• Collection of materials
  • Urine – Sulkowitch, Ross modified Rothera’s and Wallace-diamond Tests.
  • Blood and serum – Glucose, Calcium, Phosphorous, Magnesium, Total Bilirubin, AST, GGT, Total Protein and Albumin
  • Milk - Ross modified Rothera’s Test
  • Rumen Liquor – pH, Colour, Odour, Consistency and SAT; MBRT, Microbial alterations.
Based on Urinalysis following groups were made,

✓ Group I: Healthy animals
✓ Group II: a. PPI + subclinical hypocalcaemia
           b. PPI + subclinical ketosis
✓ Group III: PPI + hepatic involvement
✓ Group IV: a. PPI + hepatic involvement + subclinical hypocalcaemia.
           b. PPI + hepatic involvement + subclinical ketosis
✓ Group V: PPI alone
### Therapy

<table>
<thead>
<tr>
<th>IIa₁</th>
<th>Calboral 450 ml i/v for 2 days.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa₂</td>
<td>Calup Gel 300 g P.O for 2 days.</td>
</tr>
<tr>
<td>IIb₁</td>
<td>Inj. Rintose @ 0.5 g/Kg b wt i/v for 2 days and Inj. Laurabolin 100 mg i/m single dose.</td>
</tr>
<tr>
<td>IIb₂</td>
<td>Inj. Rintose @ 0.5 g/Kg b wt i/v for 2 days and Ketonex Boli 4 per day for 3 days P.O.</td>
</tr>
<tr>
<td></td>
<td>Therapy</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
</tr>
<tr>
<td>IIIa</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v for one day and Inj. Livadex Forte 10 ml i/m for 3 days.</strong></td>
</tr>
<tr>
<td>IIIb</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v for one day and Inj. Toxol 10 ml i/m for 3 days.</strong></td>
</tr>
<tr>
<td>IVa</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v and Inj. Tribivet 10 ml i/m for 3 days, and Calup Gel 300 g P.O for 2 days.</strong></td>
</tr>
<tr>
<td>IVb</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v for 3 days, Inj. Laurabolin 100 mg i/m single dose and Bolus Zigbo 2 boli for 5 days orally.</strong></td>
</tr>
<tr>
<td>Va</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v, Inj. Anistamin 10 ml i/m for one day and Bolus Ecotas 2 per day for 4 days P.O.</strong></td>
</tr>
<tr>
<td>Vb</td>
<td><strong>Inj. Rintose @ 0.5 g/Kg b wt i/v, Inj. Anistamin 10 ml i/m for one day and Bolus Rumentas 4 per day (2 boli b.i.d) for 3 days P.O.</strong></td>
</tr>
</tbody>
</table>
RESULTS & DISCUSSION
• Period of study - 17 months

Incidence of PPI
## Incidence of PPI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Item</th>
<th>No. of buffaloes</th>
<th>Incidence (%)</th>
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<tbody>
<tr>
<td>1</td>
<td>Hepatic disorders</td>
<td>43</td>
<td>47.78</td>
</tr>
<tr>
<td></td>
<td>i. Hepatic disorders alone</td>
<td>23</td>
<td>25.56</td>
</tr>
<tr>
<td></td>
<td>ii. Hepatic disorders and production diseases</td>
<td>20</td>
<td>22.22</td>
</tr>
<tr>
<td></td>
<td>a. Hepatic disorders and hypocalcaemia</td>
<td>10</td>
<td>11.11</td>
</tr>
<tr>
<td></td>
<td>b. Hepatic disorders and ketosis</td>
<td>10</td>
<td>11.11</td>
</tr>
<tr>
<td>2</td>
<td>Production diseases</td>
<td>27</td>
<td>30.00</td>
</tr>
<tr>
<td></td>
<td>i. Sub clinical hypocalcaemia</td>
<td>14</td>
<td>15.56</td>
</tr>
<tr>
<td></td>
<td>ii. Sub-clinical ketosis</td>
<td>13</td>
<td>14.44</td>
</tr>
<tr>
<td>3</td>
<td>PPI alone</td>
<td>20</td>
<td>22.22</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>90</td>
<td>100.00</td>
</tr>
</tbody>
</table>
• CLINICAL SIGNS

- Decreased appetite
- Reduction in milk yield.
- Temperature, Pulse and Respirations were normal.
- Decreased Ruminal motility.
URINE ANALYSIS:

- Wallace-Diamond Test
- Ross modified Rothera’s Test
- Sulkowitch Test
## URINE ANALYSIS:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>Groups</th>
<th>Before treatment</th>
<th>After treatment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IIa₁</td>
<td>IIa₂</td>
<td>IIb₁</td>
</tr>
<tr>
<td>1</td>
<td>Calcium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIa₁</td>
<td>IIa₂</td>
<td>IIb₁</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>2</td>
<td>Ketone bodies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIa₁</td>
<td>IIa₂</td>
<td>IIb₁</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-ve</td>
<td>-ve</td>
<td>+ to ++</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-ve</td>
<td>-ve</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLR</td>
<td>PLR</td>
<td>PLR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLR</td>
<td>PLR</td>
<td>PLR</td>
</tr>
<tr>
<td>L = Low</td>
<td>N = Normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-ve = Negative</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| CR = Cherry Red | PLR = Pink to Light Red
# REDUCTION (%) IN MILK YIELD OF PPI BUFFALOES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Groups</th>
<th>Average milk yield (L/day)</th>
<th>Milk Yield (L/day) prior</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hepatic disorders and production diseases</td>
<td>8.70 ± 0.51</td>
<td>4.51 ± 0.57</td>
<td>48.13</td>
</tr>
<tr>
<td>2</td>
<td>Subclinical Ketosis</td>
<td>8.08 ± 0.46</td>
<td>4.35 ± 0.50</td>
<td>46.19</td>
</tr>
<tr>
<td>3</td>
<td>Hepatic disorders alone</td>
<td>8.91 ± 0.42</td>
<td>5.04 ± 0.34</td>
<td>43.41</td>
</tr>
<tr>
<td>4</td>
<td>Subclinical Hypocalcaemia</td>
<td>9.36 ± 0.36</td>
<td>5.39 ± 0.58</td>
<td>42.37</td>
</tr>
<tr>
<td>5</td>
<td>PPI alone</td>
<td>8.95 ± 0.30</td>
<td>5.95 ± 0.34</td>
<td>33.52</td>
</tr>
</tbody>
</table>
Average milk yield (L/day) before and after therapy

Average milk yield (L/day) before and after therapy is shown in the graph. The graph compares the milk yield for different groups (IIa1, IIa2, IIb1, IIb2, IIIa, IIIb, Iva, Ivb, Va, Vb) before and after treatment. The bars represent the milk yield with blue for 'Before Treatment' and red for 'After Treatment'.
# Mean Serum parameters of Group I (Healthy) animals

<table>
<thead>
<tr>
<th>S. No</th>
<th>Glucose mg/dL</th>
<th>Calcium mg/dL</th>
<th>Phosphorous mg/dl</th>
<th>Magnesium mg/dL</th>
<th>Total Bilirubin mg/dL</th>
<th>Cholesterol mg/dL</th>
<th>AST U/L</th>
<th>GGT U/L</th>
<th>Total protein g/dL</th>
<th>Albumin g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53.05</td>
<td>9.41</td>
<td>4.32</td>
<td>2.10</td>
<td>0.27</td>
<td>58</td>
<td>89.00</td>
<td>43.20</td>
<td>6.3</td>
<td>2.69</td>
</tr>
<tr>
<td>2</td>
<td>59.06</td>
<td>9.12</td>
<td>5.26</td>
<td>2.20</td>
<td>0.18</td>
<td>128</td>
<td>89.00</td>
<td>24.81</td>
<td>7.9</td>
<td>2.53</td>
</tr>
<tr>
<td>3</td>
<td>55.66</td>
<td>8.63</td>
<td>4.60</td>
<td>2.24</td>
<td>0.25</td>
<td>139</td>
<td>127.80</td>
<td>49.97</td>
<td>7.2</td>
<td>2.78</td>
</tr>
<tr>
<td>4</td>
<td>50.29</td>
<td>9.15</td>
<td>4.75</td>
<td>2.32</td>
<td>0.45</td>
<td>90</td>
<td>130.40</td>
<td>27.94</td>
<td>6.4</td>
<td>2.62</td>
</tr>
<tr>
<td>5</td>
<td>58.26</td>
<td>8.49</td>
<td>5.32</td>
<td>2.31</td>
<td>0.23</td>
<td>121</td>
<td>117.01</td>
<td>43.00</td>
<td>6.8</td>
<td>2.39</td>
</tr>
<tr>
<td>6</td>
<td>57.08</td>
<td>9.21</td>
<td>4.96</td>
<td>2.24</td>
<td>0.49</td>
<td>103</td>
<td>119.01</td>
<td>25.09</td>
<td>6.8</td>
<td>2.57</td>
</tr>
<tr>
<td>7</td>
<td>55.09</td>
<td>8.79</td>
<td>6.08</td>
<td>2.31</td>
<td>0.35</td>
<td>107</td>
<td>114.01</td>
<td>44.23</td>
<td>6.6</td>
<td>2.69</td>
</tr>
<tr>
<td>8</td>
<td>52.05</td>
<td>9.13</td>
<td>5.21</td>
<td>2.41</td>
<td>0.36</td>
<td>118</td>
<td>119.46</td>
<td>38.96</td>
<td>6.4</td>
<td>2.73</td>
</tr>
<tr>
<td>9</td>
<td>58.91</td>
<td>9.46</td>
<td>5.38</td>
<td>2.44</td>
<td>0.37</td>
<td>122</td>
<td>118.32</td>
<td>44.32</td>
<td>6.3</td>
<td>2.84</td>
</tr>
<tr>
<td>10</td>
<td>50.28</td>
<td>8.93</td>
<td>4.91</td>
<td>2.56</td>
<td>0.25</td>
<td>131</td>
<td>113.04</td>
<td>29.81</td>
<td>6.4</td>
<td>2.92</td>
</tr>
<tr>
<td>Mean±SE</td>
<td>54.97 ± 1.08</td>
<td>9.03 ± 0.10</td>
<td>5.08 ± 0.15</td>
<td>2.31 ± 0.04</td>
<td>0.32 ± 0.03</td>
<td>111.70 ± 7.50</td>
<td>113.7 ± 4.46</td>
<td>37.13 ± 2.94</td>
<td>6.71 ± 0.16</td>
<td>2.68 ± 0.05</td>
</tr>
</tbody>
</table>
### Mean Serum Glucose levels (mg/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ila1</td>
<td>61.51</td>
<td>52.68</td>
</tr>
<tr>
<td>Ila2</td>
<td>67.08</td>
<td>59.71</td>
</tr>
<tr>
<td>Iib1</td>
<td>37.43</td>
<td>50.18</td>
</tr>
<tr>
<td>Iib2</td>
<td>41.35</td>
<td>54.73</td>
</tr>
<tr>
<td>IIIa</td>
<td>45.98</td>
<td>55.87</td>
</tr>
<tr>
<td>IIIb</td>
<td>50.53</td>
<td>59.73</td>
</tr>
<tr>
<td>IVa</td>
<td>42.98</td>
<td>56.75</td>
</tr>
<tr>
<td>IVb</td>
<td>43.79</td>
<td>60.62</td>
</tr>
<tr>
<td>Va</td>
<td>60.77</td>
<td>54.42</td>
</tr>
<tr>
<td>Vb</td>
<td>54.77</td>
<td>44.97</td>
</tr>
</tbody>
</table>

**Significance levels:**
- **:** p < 0.05
- ***:** p < 0.01

**Groups:** Ila1, Ila2, Iib1, Iib2, IIIa, IIIb, IVa, IVb, Va, Vb
Mean serum Calcium levels (mg/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa1</td>
<td>6.73</td>
<td>8.67</td>
</tr>
<tr>
<td>IIa2</td>
<td>6.02</td>
<td>9.02</td>
</tr>
<tr>
<td>IIb1</td>
<td>7.5</td>
<td>8.22</td>
</tr>
<tr>
<td>IIb2</td>
<td>6.07</td>
<td>6.67</td>
</tr>
<tr>
<td>IIIa</td>
<td>7.85</td>
<td>9.13</td>
</tr>
<tr>
<td>IIIb</td>
<td>7.45</td>
<td>8.16</td>
</tr>
<tr>
<td>IVa</td>
<td>5.28</td>
<td>9.08</td>
</tr>
<tr>
<td>IVb</td>
<td>5.84</td>
<td>8.09</td>
</tr>
<tr>
<td>Va</td>
<td>6.94</td>
<td>8.66</td>
</tr>
<tr>
<td>Vb</td>
<td>8.01</td>
<td>8.48</td>
</tr>
</tbody>
</table>

Calcium levels (mg/dL)

Before treat: 6.73, 6.02, 7.5, 6.07, 7.85, 7.45, 5.28, 5.84, 6.94, 8.01
After treat: 8.67, 9.02, 8.22, 6.67, 9.13, 8.16, 9.08, 8.09, 8.66, 8.48
### Mean serum Phosphorous levels (mg/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Phosphorous levels (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treat</td>
<td>After treat</td>
</tr>
<tr>
<td>IIa1</td>
<td>4.41</td>
</tr>
<tr>
<td>IIa2</td>
<td>4.72</td>
</tr>
<tr>
<td>IIb1</td>
<td>5.08</td>
</tr>
<tr>
<td>IIb2</td>
<td>5.69</td>
</tr>
<tr>
<td>IIIa</td>
<td>4.93</td>
</tr>
<tr>
<td>IIIb</td>
<td>4.84</td>
</tr>
<tr>
<td>IVa</td>
<td>5.51</td>
</tr>
<tr>
<td>IVb</td>
<td>4.83</td>
</tr>
<tr>
<td>Va</td>
<td>4.92</td>
</tr>
<tr>
<td>Vb</td>
<td>4.80</td>
</tr>
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</table>

* * *
<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa1</td>
<td>3.81</td>
<td>2.39</td>
</tr>
<tr>
<td>IIa2</td>
<td>3.35</td>
<td>2.28</td>
</tr>
<tr>
<td>IIb1</td>
<td>2.46</td>
<td>2.36</td>
</tr>
<tr>
<td>IIb2</td>
<td>2.24</td>
<td>2.17</td>
</tr>
<tr>
<td>IIIa</td>
<td>2.27</td>
<td>2.43</td>
</tr>
<tr>
<td>IIb</td>
<td>2.56</td>
<td>2.25</td>
</tr>
<tr>
<td>IVa</td>
<td>2.50</td>
<td>2.19</td>
</tr>
<tr>
<td>IVb</td>
<td>2.30</td>
<td>2.18</td>
</tr>
<tr>
<td>Va</td>
<td>2.27</td>
<td>2.11</td>
</tr>
<tr>
<td>Vb</td>
<td>2.16</td>
<td>2.24</td>
</tr>
</tbody>
</table>
Mean serum Total bilirubin levels (mg/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa1</td>
<td>0.39</td>
<td>0.32</td>
</tr>
<tr>
<td>IIa2</td>
<td>0.34</td>
<td>0.27</td>
</tr>
<tr>
<td>IIb1</td>
<td>0.50</td>
<td>0.22</td>
</tr>
<tr>
<td>IIb2</td>
<td>0.37</td>
<td>0.18</td>
</tr>
<tr>
<td>IIIa</td>
<td>0.49</td>
<td>0.43</td>
</tr>
<tr>
<td>IIIb</td>
<td>0.50</td>
<td>0.32</td>
</tr>
<tr>
<td>IVa</td>
<td>0.47</td>
<td>0.33</td>
</tr>
<tr>
<td>IVb</td>
<td>0.55</td>
<td>0.29</td>
</tr>
<tr>
<td>Va</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>Vb</td>
<td>0.18</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Significance levels: ** for p < 0.01, * for p < 0.05.
Mean serum cholesterol levels (mg/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ila1</td>
<td>121.00</td>
<td>122.17</td>
</tr>
<tr>
<td>Ila2</td>
<td>144.00</td>
<td>108.50</td>
</tr>
<tr>
<td>IIb1</td>
<td>119.20</td>
<td>117.20</td>
</tr>
<tr>
<td>IIb2</td>
<td>139.13</td>
<td>136.25</td>
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<tr>
<td>IIIa</td>
<td>123.50</td>
<td>123.50</td>
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<tr>
<td>IIIb</td>
<td>140.30</td>
<td>122.70</td>
</tr>
<tr>
<td>IVa</td>
<td>113.50</td>
<td>105.30</td>
</tr>
<tr>
<td>IVb</td>
<td>124.94</td>
<td>117.90</td>
</tr>
<tr>
<td>Va</td>
<td>123.54</td>
<td>106.42</td>
</tr>
<tr>
<td>Vb</td>
<td>106.42</td>
<td>95.66</td>
</tr>
</tbody>
</table>

**Groups**

- Ila1
- Ila2
- IIb1
- IIb2
- IIIa
- IIIb
- IVa
- IVb
- Va
- Vb

*Before treat*

*After treat*

**Note:** The table shows the mean serum cholesterol levels before and after treatment for different groups, with statistical significance indicated by ** and * symbols.
Mean serum AST levels (U/L)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa1</td>
<td>149.42</td>
<td>108.67</td>
</tr>
<tr>
<td>IIa2</td>
<td>124.92</td>
<td>103.19</td>
</tr>
<tr>
<td>IIb1</td>
<td>125.86</td>
<td>106.86</td>
</tr>
<tr>
<td>IIb2</td>
<td>147.17</td>
<td>107.86</td>
</tr>
<tr>
<td>IIIa</td>
<td>182.69</td>
<td>134.87</td>
</tr>
<tr>
<td>IIIb</td>
<td>152.21</td>
<td>110.98</td>
</tr>
<tr>
<td>Iva</td>
<td>126.60</td>
<td>96.52</td>
</tr>
<tr>
<td>IVb</td>
<td>151.27</td>
<td>117.42</td>
</tr>
<tr>
<td>Va</td>
<td>95.63</td>
<td>94.71</td>
</tr>
<tr>
<td>Vb</td>
<td>95.83</td>
<td>90.85</td>
</tr>
</tbody>
</table>

* * * *
## Mean serum GGT levels (U/L)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa1</td>
<td>39.71</td>
<td>36.39</td>
</tr>
<tr>
<td>IIa2</td>
<td>51.68</td>
<td>47.81</td>
</tr>
<tr>
<td>IIb1</td>
<td>49.32</td>
<td>31.82</td>
</tr>
<tr>
<td>IIb2</td>
<td>61.22</td>
<td>42.60</td>
</tr>
<tr>
<td>IIIa</td>
<td>41.48</td>
<td>32.61</td>
</tr>
<tr>
<td>IIIb</td>
<td>46.74</td>
<td>35.42</td>
</tr>
<tr>
<td>IVa</td>
<td>53.72</td>
<td>44.92</td>
</tr>
<tr>
<td>IVb</td>
<td>44.77</td>
<td>36.27</td>
</tr>
<tr>
<td>Vb</td>
<td>36.33</td>
<td>33.76</td>
</tr>
</tbody>
</table>

### Notes:
- **Before treat** values are shown in blue bars.
- **After treat** values are shown in maroon bars.
- Levels marked with two asterisks (**) indicate significant differences.
- Levels marked with one asterisk (*) indicate moderate differences.

**Groups**

- IIa1
- IIa2
- IIb1
- IIb2
- IIIa
- IIIb
- IVa
- IVb
- Vb
Mean serum Total protein levels (g/dL)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIa</td>
<td>6.02</td>
<td>6.46</td>
</tr>
<tr>
<td>IIa1</td>
<td>6.15</td>
<td>7.03</td>
</tr>
<tr>
<td>IIa2</td>
<td>6.70</td>
<td>7.24</td>
</tr>
<tr>
<td>IIb</td>
<td>6.32</td>
<td>7.10</td>
</tr>
<tr>
<td>IIb1</td>
<td>5.78</td>
<td>7.18</td>
</tr>
<tr>
<td>IIb2</td>
<td>6.19</td>
<td>7.00</td>
</tr>
<tr>
<td>IIIa</td>
<td>5.43</td>
<td>7.42</td>
</tr>
<tr>
<td>IIIa1</td>
<td>5.25</td>
<td>6.56</td>
</tr>
<tr>
<td>IIIa2</td>
<td>5.82</td>
<td>6.23</td>
</tr>
<tr>
<td>IIIb</td>
<td>6.06</td>
<td>6.33</td>
</tr>
</tbody>
</table>

* * ** ** ** **
<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treat</th>
<th>After treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ila</td>
<td>2.35</td>
<td>2.45</td>
</tr>
<tr>
<td>Ila2</td>
<td>2.14</td>
<td>2.57</td>
</tr>
<tr>
<td>Ilb1</td>
<td>2.61</td>
<td>2.64</td>
</tr>
<tr>
<td>Ilb2</td>
<td>2.35</td>
<td>2.54</td>
</tr>
<tr>
<td>IIla</td>
<td>2.29</td>
<td>2.60</td>
</tr>
<tr>
<td>IIb</td>
<td>2.30</td>
<td>2.50</td>
</tr>
<tr>
<td>Iva</td>
<td>1.91</td>
<td>2.58</td>
</tr>
<tr>
<td>IVb</td>
<td>1.73</td>
<td>2.37</td>
</tr>
<tr>
<td>Va</td>
<td>2.33</td>
<td>2.64</td>
</tr>
<tr>
<td>Vb</td>
<td>2.53</td>
<td>2.57</td>
</tr>
</tbody>
</table>

**Mean serum Albumin levels (g/dL)**
## Rumen fluid analysis of buffaloes before and after treatment among Groups Va and Vb

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>Group Va</th>
<th>Group Vb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Before treatment</td>
<td>After treatment</td>
</tr>
<tr>
<td>1</td>
<td>Colour</td>
<td>Dark brown</td>
<td>Brownish green</td>
</tr>
<tr>
<td>2</td>
<td>Odour</td>
<td>Stale</td>
<td>Aromatic</td>
</tr>
<tr>
<td>3</td>
<td>Consistency</td>
<td>Watery</td>
<td>Slightly viscous</td>
</tr>
<tr>
<td>4</td>
<td>pH</td>
<td>8.00 ± 0.00</td>
<td>6.80 ± 0.13</td>
</tr>
<tr>
<td>5</td>
<td>SAT (minutes)</td>
<td>7.55 ± 0.37</td>
<td>6.93 ± 0.10</td>
</tr>
<tr>
<td>6</td>
<td>MBRT (minutes)</td>
<td>5.05 ± 0.01</td>
<td>3.02 ± 0.32</td>
</tr>
<tr>
<td>7</td>
<td>Protozoan activity</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>8</td>
<td>Protozoan concentration/LPF</td>
<td>+</td>
<td>+++</td>
</tr>
</tbody>
</table>
Therapeutic efficacy based on improvement percentage in milk yield and recovery

- Improvement (%)
- Recovery days

Therapeutic efficacy based on improvement percentage in milk yield and recovery.
## Therapeutic efficacy of different treatments

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>Comparative Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Healthy</td>
</tr>
<tr>
<td>1.</td>
<td>Serum calcium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>2.</td>
<td>Serum glucose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>54.97&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54.97&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54.97&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.</td>
<td>Serum AST</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>113.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>113.71</td>
</tr>
<tr>
<td>4.</td>
<td>Serum GGT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.13</td>
</tr>
</tbody>
</table>

* Means with different alphabets as superscripts differ significantly (P<0.05)
CONCLUSIONS

- Inadequate supply of nutrients to the body due to ruminal disorders is the cause of insufficiency of the liver.

- The treatment of PPI in buffaloes,
  - Hepatoprotective and liver stimulant drugs
  - i/v glucose,
  - Oral calcium preparation and
  - Combination of probiotics and prebiotics

- Urine analysis on day 15, 30, 45 and 60 postpartum for bile pigments is recommended for early detection and prevention of PPI in buffaloes.
Thank you